APPENDIX A

Description

A Syntactic Query Engine

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1 Abstract

The techniques described herein are used to create a Syntactic Query Engine that provides enhanced document indexing as well as syntactic-based searches. The approach comprises the following four steps:

INDEXING

1. Existing parsing technology is adapted to output an abstract representation for sentences that is suitable for cross-document indexing. A central idea is to collapse selected nodes in a full linguistic parse tree into a simpler dependency structure that also captures more valuable information through field redundancy
2. Smart indexing structures are created for storing, searching and manipulating sentence structures. The dependency structures output by the modified parser are stored in sets of disjoint clustered tables, each storing the same "pair" of syntactic relationships detected across a large corpus.

SEARCH

3. New search operators are developed based on the indexing structures described above. These include structured searches where keywords can be constrained to obey a precise syntactic role, such as subject, object, governing verb of a sentence, preposition or verb modifier. A methodology for sentence similarity searching is also implemented.
4. A new Graphical User Interface (GUI) concept for browsing the results of the syntactic search has been developed. This GUI introduces a new paradigm for search engines. First, it allows the user to specify the syntactic role that keywords in the input query must obey. For instance, the user may enter the keywords "Bill Clinton" with the constraint that these keywords must be the governing subjects of an action or sentence. Second, it allows three levels of progressive information discovery, corresponding to three successive screen views. At the first level, the GUI displays a list of all actions (verbs or verb phrases) found in a large corpus of documents that obey the query constraints. Using the above example, these actions could be a list of the following keywords: *win, speak, travel to, rule, lie, deny, address, etc.* This list gives the user a birdseye view of all possible actions and involvements of the entity or object about which he or she is seeking information. Each of the verbs or actions in the list is automatically linked (*e.g.*, using a hyperlink or other linking technique) to a sentence that describes the complete relationship. At the second level, the user can select any of these actions and view a complete list of sentences for each action. Each of the sentences is in turn linked with the full text of the document. At the third level, the user can select any of these sentences and view the sentence in the context of the full document.

2 Technical Background

The notion of "document as a bag of sentences" indexing rests on the principles of linguistic normalization. Linguistic normalization maps semantically equivalent sentences into one canonical sentence representation. It operates at three levels: morphological, semantic and syntactic. Morphological normalization is usually referred to as stemming or conflation. Semantic normalization involves recognition of keyword relationships such as synonyms, antonyms and meronyms. Syntactic normalization may involve transformational rules that recognize the semantic equivalence of different phrase structures.

The enhanced indexing and search technology described herein encompasses proprietary algorithms for morphological, semantic and syntactic modeling of languages. A strength of this approach is that the models are statistical in nature, and can be adapted to cross-lingual and even multimedia data dimensions. For instance, for morphological normalization, a conflation technique has been developed based on the statistics of n-grams. A weighted similarity measure is used to produce a similarity matrix that is clustered via hierarchical agglomerative clustering methods. This morphological model is language independent and robust to OCR and speech recognition errors. As such it can be applied to the output of an ASR system operating, for example, on a video audio track.

2.1 Syntactic Indexing Framework

2.1.1 Parser Technology

The enhanced indexing and search technology is being used to develop commercial Q&A solutions (*e.g.*, a Syntactic Query Engine) based on a variety of parsing technologies. These include: 1) principle based parsing and 2) stochastic parsing. Minipar (D. Lin, 1993) is an example of the first. It is a principle-based parser. Unlike rule-based grammars, which tend to produce a large number of rules to describe specific language patterns, Minipar is based on more fundamental and universal principles based on the government-binding theory (Chomsky, 1981). It achieves a relatively small number of candidate syntactic structures by applying principles to descriptions of the structures rather than to the structures themselves. Minipar carries out the parsing through an efficient message-passing algorithm. A stochastic parser is also being developed based on the Structured Language Model (SLM) conceived by C. Chelba and F. Jelinek (2000). The key features of this parser are its capacity to model and handle context dependence, its flexibility, and its computational tractability. For example, the parser has the capability of deciding part of speech and governor phrases for each term in a sentence, based on a search over the whole sentence. Hence the decisions are context-dependent as opposed to decisions made by parsers that just look at a limited history (terms preceding the particular term in the sentence) of each term, such as parsers based on hidden Markov models (HMM) (i.e. stochastic linear grammars). The parsing structure output by the parser can be represented by a binary tree. This offers a computational advantage, making the parsing algorithm tractable in a similar way to stochastic parsers based on context-free grammars. EM-type (Estimation-Maximization) re-estimation formulas (such as those used in HMM), can be derived to ease training of the parser parameters. Also,

solutions based on sub-optimal parsing strategies, such as Monte Carlo techniques, are being developed, that speed up the search for the most likely parsing of a given sentence. Functionality from multiple parsers may be incorporated into a more robust product, and the rule-based grammar approach may be extended to a number of other languages.

A parser labels every word of every sentence in every document as follows:

<term, part-of-speech, dependency-relation-with-head, head-term, document#, sentence#>

where:
term= word (stemmed or root word)
part-of-speech (pos) = noun, verb, adjective, etc.
head= term
dependency-relation-with-head= syntactic relationship between head and term.
e.g. modifier, noun-noun, subject, object.
Document # = document identifier
Sentence # = sentence number within the document #

Each record defines a node of a hierarchical tree structure of the kind shown in Figure 1.

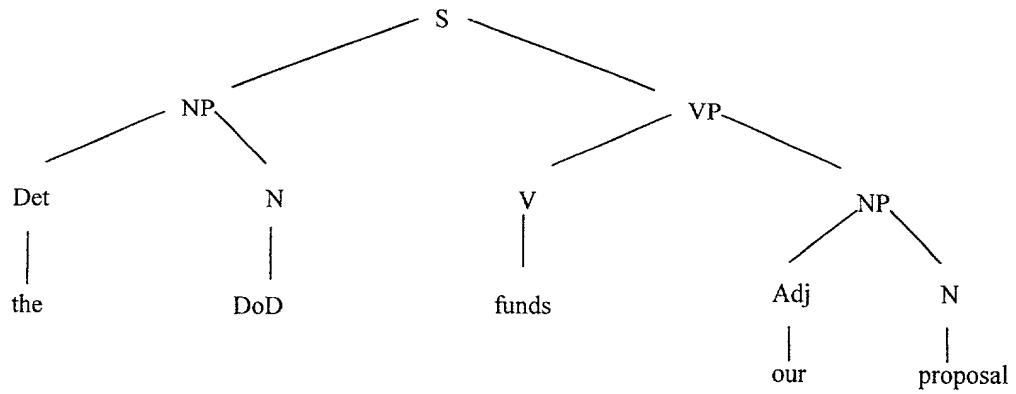


Figure 1: A phrase structure tree

The Syntactic Query Engine reconstructs augmented parse trees by joining all records from a single sentence. However, this structure does not provide efficient information access. This complex output is reduced to a "fact database" by collapsing information in the subject, verb and object categories into two relational tables. In deriving the subject-verb-object triplets the Syntactic Query Engine discards noun modifiers that have little or no semantic value.

2.1.2 Smart Syntactic Structures

As previously stated, a full linguistic parse tree does not lead to a tractable syntactic indexing scheme for cross-document analysis. The enhanced indexing and search techniques provide a set of rules for converting an augmented tree representation into a more robust and scalable data structure. The basic idea involves collapsing selected nodes

to reduce the complexity of the dependency structures. Through government-binding principles, a sentence can be described by a set of triplets of the form [head-term, term, relation], where term is a word in the sentence, head-term is the word's governor word, and relation specifies the particular syntactic relation binding the term to is head-term. Certain triplets are more informative than others in the sense that they by themselves convey most of a sentence message content. Among these triplets, triplets of the form [head is verb, term is noun/adjective, term is bound to the main subject of the verb], [head is verb, term is noun/adjective, term is bound to the object of the verb], or [head is verb+preposition, term is noun/adjective, term is bound to the preposition following the verb] are singled out. The last triplets are useful in answering queries regarding location (via the prepositions in, on, by, over, etc.), description (e.g. as), association (e.g. with, of), direction (e.g. to, from), time (e.g. after, before), purpose (e.g. for), etc. Other triplets are also relevant, such as those linking subject and objects directly: [noun A, noun B, term A and term B are connected through a verb as subject-object]. Even though these last triplets may not seem relevant within a sentence, they could potentially solve for ambiguities within a document. Also, when no verbs are present in the text (e.g. a title) triplets of the form [head is noun term, term is noun/adjective, noun term governs noun/adjective term] convey most of the relevant information.

The enhanced indexing and search techniques extract these triplets from a parser's output for a sentence, by introducing rules that act on the full parse tree for that sentence. First, the governing verb(s) in the sentence is (are) identified. For each verb (or verbal form) in the sentence , direct links representing the subject or the object associated to the verb are identified. Then, all terms that are indirectly and eventually bound either to the subject or to the object are identified. This search is not straightforward. Sentences phrased in passive-voice style, or with several clauses in them, are particularly difficult. Also, prepositions do not always immediately follow the verb; sometimes they even appear earlier than their associated verbs. These cases, as well as many others, are detected by traversing the parsing tree structure, and keeping records of the relative node position of the terms in the tree (e.g. node at the same height of the tree might be related to the same verb). Several terms may be eventually bound to both the subject and the object through the same verb. Additional rules are applied to filter intervening or contradictory triplets and non-diagnostic parts of speech. Finally, the transformed output from a single sentence is stored into a set of disjoint tables. These tables may be queried at a later time, by means of join and merge operators

2.1.3 Elementary Coreferencing Rules

The enhanced indexing and search techniques are usually able to bind pronouns (*e.g.*, "it", "that", "them") to their "antecedent", since parsers frequently capture antecedents. The following example serves as an illustration. Consider the sentence "African bees attack humans that provoke them", and an example parsing tree associated to it (as output by Minipar):

```
E1    (()    fin C  *     )
1     (African      ~A   2     mod    (gov bee))
2     (bees   bee N  3     s      (gov attack))
```

```
3    (attack ~ V_N_N E1    i     (gov fin))
E3   (()   bee N  3     subj  (gov attack)  (antecedent 2))
4    (humans human N 3     obj   (gov attack))
E0   (()   fin C  4     rel   (gov human))
5    (that  ~ THAT  E0    whn   (gov fin)     (antecedent 4))
6    (provoke     ~ V_N_N E0    i     (gov fin))
E4   (()   that THAT    6     subj  (gov provoke)  (antecedent 4))
7    (them  ~ N    6     obj   (gov provoke))
```

There are two terms whose antecedents need to be found. They are "that" and "them". The first term, "that", is the subject of "provoke". Here its antecedent is given by the parser. However, if this were not the case (as might occur with more complex sentences), the antecedent could easily be obtained by noticing that the clause associated with "that", hangs directly under the parent node, "humans". Hence, "humans" is the corresponding antecedent. The antecedent of the second term "them" is more difficult to elucidate. First it is the subject of "provoke", hence it cannot co-refer "humans" since this term is the subject of "provoke". Hence, nouns that are not bound to the term "humans" are determined among those found in the immediate precedent clause. In this case the only such noun is "bees", so this is the corresponding antecedent. Co-referencing in a document is similarly done. The ordered sequence of paragraphs is seen as a linear tree, where each node represents a paragraph, and each paragraph is headed by the preceding one. The first paragraph is headed by a symbolic root node (the document). Each paragraph node is similarly decomposed as a linear tree formed by the nested parsing trees of all sentences within the paragraph. The main idea is to see sentences within a single paragraph as consecutive "clauses" which are nested one after the other. These nested parsing trees form an unbalanced paragraph parsing tree that is heavier to its right. Co-reference is solved for as it would be solved for in a single parse tree.

Table 1 is an example set of data structures employed in an example implementation of sentence decomposition for a prototype collection of documents. The table entries correspond to the first four sentences of the same abstract. All four tables are incremented with parsed information from additional abstracts. The prototype collection involved 50,000 abstracts and the implementation supported the scalability of the approach to large collections.

Table 1

Subjects Table

Subject	Verb	DocID	SentenceID
cervical	be	20450337	1
Spondylotic	be	20450337	1
Myelopathy	be	20450337	1
aging	result	20450337	2
Process	result	20450337	2
Degenerative	cause	20450337	2
Change	cause	20450337	2
Cervical	cause	20450337	2
Spine	cause	20450337	2
Symptom	develop	20450337	3
differential	include	20450337	4
Diagnosis	include	20450337	4

Objects Table

Verb	Object	DocID	SentenceID
be	cause	20450337	1
be	the most	20450337	1
be	common	20450337	1
be	spinal cord	20450337	1
be	dysfunction	20450337	1
be	older	20450337	1
be	person	20450337	1
cause	compression	20450337	2
cause	spinal cord	20450337	2
develop	insidiously	20450337	3
characterize	symptom	20450337	3
include	condition	20450337	4
include	myelopathy	20450337	4
include	multiple sclerosis	20450337	4
include	amyotrophic	20450337	4
include	lateral	20450337	4
include	sclerosis	20450337	4
include	masses	20450337	4
include	metastatic tumor	20450337	4
include	spinal cord	20450337	4
press	metastatic tumor	20450337	4

VerbModifier Table

Verb	Preposition	VerbModifier	DocID	SentenceID
result	in	degenerative	20450337	2
result	in	change	20450337	2
result	in	spine	20450337	2
result	in	advanced	20450337	2
result	in	stage	20450337	2
result	in	compression	20450337	2
result	in	spinal cord	20450337	2
cause	in	advanced	20450337	2
cause	in	stage	20450337	2
characterize	by	neck	20450337	3
characterize	by	stiffness	20450337	3
characterize	by	arm	20450337	3
characterize	by	pain	20450337	3
characterize	by	numbness	20450337	3
characterize	by	hand	20450337	3
characterize	by	weakness	20450337	3
characterize	by	leg	20450337	3
result	in	myelopathy	20450337	4
result	such as	multiple sclerosis	20450337	4
press	on	spinal cord	20450337	4

Sentence Table

Sentence	DocID	SentenceID
Cervical spondylotic myelopathy is the most common cause of spinal cord dysfunction in older persons	20450337	1
The aging process results in degenerative changes in the cervical spine that, in advanced stages, can cause compression of the spinal cord	20450337	2
Symptoms often develop insidiously and are characterized by neck stiffness, arm pain, numbness in the hands, and weakness of the hands and legs	20450337	3
The differential diagnosis includes any condition that can result in myelopathy, such as multiple sclerosis, amyotrophic lateral sclerosis and masses (such as metastatic tumors) that press on the spinal cord	20450337	4

2.1.4 Storage and Access

Using the enhanced search and indexing techniques, the Syntactic Query Engine stores the modified parser output as sets of disjoint tables of similar syntactic primitives. For the sake of simplicity, an example is presented with a set of relational database tables that store only three types of coarse syntactic relationships: 1) subject-verb; 2) verb-object; and 3) verb-preposition-verbModifier. (Any number of other syntactic relationships could be stored.) Correspondingly, the output includes a: 1) *subjects table* configured as *{Subject, Verb, SentenceID, DocID}*; 2) *objects table* configured as *{Verb, Object, SentenceID, DocID};* 3) *verb modifiers table* configured as *{Verb, Preposition, VerbModifier, SentenceID, DocID};* 4) *sentence table*, configured as *{SentenceID, DocID}*. Indices are built for each table. For instance, (1) has two indices: the first based on *Subject*, the second on *DocID* and *SentenceID*; (3) has three indices: the first based on *Verb*, the second on *VerbModifier*, and the third on *DocID* and *SentenceID*.

The output from each sentence is used to populate all three tables, each table storing the same type of syntactic relationship across a corpus. Table 1 shows an example of a possible sentence decomposition for a single Medline abstract. Note that redundancy is introduced by collapsing terms and prepositional phrases that are bound to the object and subject category into a single category. This means that more than one object or subject entity may be associated with the same governing verb of a sentence. However, the ambiguity can be resolved with a join or merge operation of a *subjects table* with an *objects table*. For instance, a union of these two tables based on the verb "cause" and the object "compression" AND/OR "spinal cord" would produce the following answer for subject: "degenerative change cervical spine". The prototype implementation of the Syntactic Query Engine applied to a subset of 50,000 Medline abstracts indicates that this redundancy does not appear to compromise performance substantially (< 0.1 sec for 5 nested joins across the full set of tables for the entire database), but increases the robustness of the data bank. These storage structures also address the difficult problem of co-referencing or tracking entities in a single document or phrase. In this implementation, data is stored based on the key of the most frequently used index. This enables fast data retrieval from disk as all data is stored in the neighboring disk blocks. In order to solve performance problems related to incremental indexing and improve scalability even more, modified database schemas and key sorting methods based on clustered tables, hash clusters, binary or R-trees may be used.

2.2 Operations on Data Structures

2.2.1 Syntax Operators, Similarity Metrics and Robust Co-referencing

The modified parser output or triplet representation relies on the identification of the governing verb of a sentence, and is verb centric. Verbs or actions govern subjects and objects. The smart structures introduced above support global search operators that can be used to profile the syntactic role of named entities across a document collection. Returning to the 50,000 Medline abstracts, the database could be queried for all subject or object roles of an entity, say "CB1" (Figure 2). The columns show the governing verbs or

actions that are bound to "CB1" according to that precise syntactic relationship across the entire corpus, arranged in order of decreasing statistical significance.

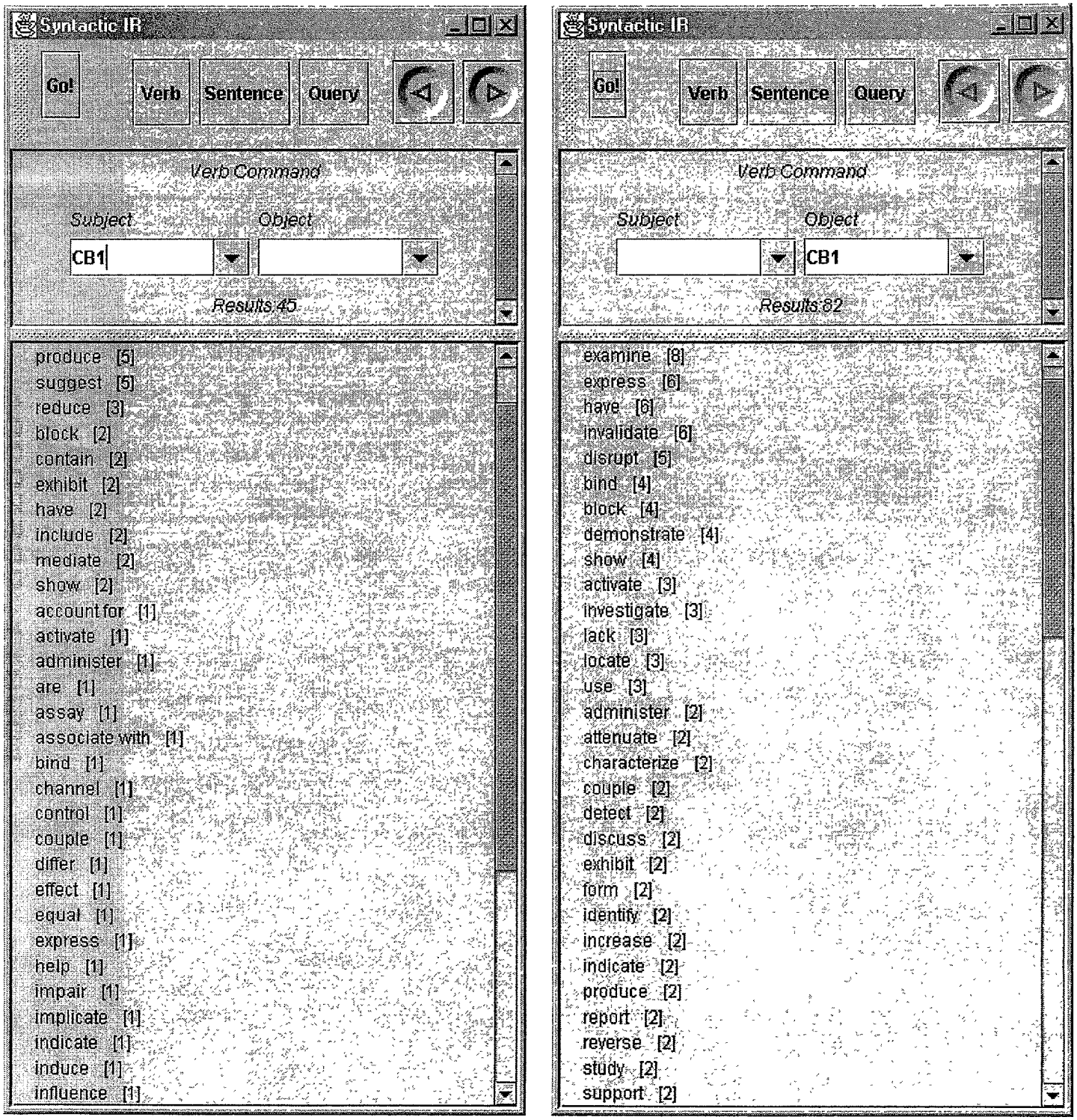


Figure 2

Figure 2 shows example syntactic profiling for keyword "CB1". Shown are possible subject or object roles that "CB1" fills in a corpus of 50,000 Medline abstracts used in the example implementation. These "action" roles are arranged in decreasing order of statistical significance.

The linguistic principle of "headness" implies that any phrase has a single head. This head is usually a noun in NPs and the main verb in the case of VPs. Although the head-modifier relation implies semantic dependence, the parser output defines a purely syntactic relationship at the single sentence level. However, the head may serve as an index for a list of phrases with occurrence frequencies across a collection. Syntactic profiling operators (like subject and object roles, and others involving prepositions and verb modifiers) are used to semantically cluster keywords based on their syntactic relationships. For instance, entities in a corpus can be associated with a "bag" of subject actions and a "bag" of object actions, as well as modifiers involving those actions. Each action in each one of these bags has a weight (the relative frequency of the noun-action pair within a document collection). Two keywords or entities are then said to be similar if their corresponding subject and object bags of actions are similar. This similarity can be quantitatively measured by the Euclidean distance between the relative frequency distributions associated with their bags of actions. Two nouns are very likely to be semantic or at least functional synonyms if their syntactic similarity is large. Hence, the enhanced search and indexing techniques solve the co-reference problem by studying the observed bag of actions statistics associated with the keywords in a corpus.

The following example illustrates this point. Consider the sentences "Several rats developed brain tumors. They spread to other organs." The possible antecedents of "They" are "brain tumors" and "rats".

action	BrainTumor	Rat	Organ	action	BrainTumor	Rat	Organ
affect	0.00	0.00	0.05	induce	0.04	0.05	0.00
appear	0.04	0.00	0.00	investigate	0.00	0.00	0.04
cause	0.00	0.00	0.04	involve	0.00	0.00	0.06
cause	0.00	0.02	0.00	model	0.00	0.08	0.00
characterize	0.00	0.00	0.04	observe	0.00	0.00	0.08
compare	0.04	0.03	0.00	occur	0.04	0.00	0.00
contain	0.04	0.06	0.00	originate	0.04	0.00	0.00
damage	0.04	0.00	0.00	overlook	0.04	0.00	0.00
decide	0.04	0.00	0.00	pose	0.04	0.00	0.00
decrease	0.00	0.03	0.05	prevent	0.00	0.00	0.04
define	0.04	0.00	0.00	produce	0.00	0.03	0.00
demonstrate	0.00	0.00	0.05	prolong	0.04	0.00	0.00
detect	0.00	0.00	0.05	provide	0.00	0.00	0.05
develop	0.04	0.03	0.00	receive	0.00	0.08	0.00
examine	0.00	0.00	0.05	release	0.04	0.00	0.00
exhibit	0.00	0.04	0.00	represent	0.00	0.00	0.04
express	0.00	0.06	0.04	result	0.00	0.05	0.00
factor	0.00	0.00	0.04	reveal	0.00	0.02	0.00
feed	0.00	0.05	0.00	show	0.12	0.14	0.06
form	0.00	0.00	0.04	suggest	0.00	0.03	0.00
give	0.00	0.03	0.00	target	0.00	0.00	0.06
implant	0.04	0.00	0.00	undergo	0.00	0.03	0.00
include	0.12	0.00	0.11	understand	0.04	0.00	0.00
increase	0.08	0.06	0.05	use	0.08	0.08	0.00

Table 2

In Table 2, relative frequencies for the top 20 actions associated to each of the terms "brain Tumor", "rat", and "organ" are shown. The first column corresponds to the union of all three terms' top 20 actions. Note: columns one and three do not add up to one due to numerical round off. Table 2 shows the union of the subject action bags (with the 20 most frequent actions) for "brain tumor" and "rat", as well as the object action bag (with the 20 most frequent actions) for "organ". The relative frequencies were computed for the top 20 actions for each of these terms in the 50,000 Medline abstracts. A zero entry in the table indicates that the action is not among the top 20 actions associated with the term heading the column. The corresponding similarities (Euclidean distances) between "brain tumor" and "organ", and "rat" and "organ" are 0.072 and 0.093, respectively. Hence "brain tumors" is the most likely antecedent of "They". Note that the relative weights 1 - (0.072/(0.072+0.093)= 0.56, and 1 - (0.093/(0.072+0.093)=0.44,
could be interpreted as corresponding probabilities of "brain tumor" and "rat" being the antecedent of "They" within the second sentence's context.

When a co-reference is not exact, a measure of uncertainty about the possible antecedents helps in any further processing of the sentences. Hence a weight or probability can be associated to triplets formed by "guessing" or "imputing" the antecedent of a co-reference. All triplets are placed in this framework by assigning a weight of 1.0 to all well-defined triplets. For the example, the associated weighted bag-of-sentences would be ([develop, several, verb-subject, 1], [develop, rat, verb-subject, 1], [develop, tumor, verb-object, 1], [develop, brain, verb-object, 1], [spread to, organ, verb-object, 1], [spread to, other, verb-object, 1], [spread to, tumor, verb-subject, 0.56], [spread to, rat, verb-subject, 0.44]). The process can be further refined by allowing a second pass over the text in order to update the weights (for example by replacing the weights with the average weights over all sentences co-referring the same object). The premise here is that a measure of uncertainty about possible antecedents is far better than a wrong antecedent.

Using the enhanced search and indexing techniques, the Syntactic Query Engine implements a scheme for phrase weighting and document similarity, which is similar to statistical weighting schemes employed for term-document matrices in information retrieval. The frequency of occurrence of the governing verb of a sentence or subject of a sentence across a document collection is normalized, in a fashion similar to IDF (inverse document frequency) weighting. With regard to within sentence and within documents normalization schemes, phrase frames may contain nested phrase frames at different depths. The main head carries the most semantic information, while head modifiers increase the amount of semantic information carried by the frame. However, the amount of information added to the head by a modifier is inversely proportional to its depth. This data is used to measure sentence statistics within and across documents, and to define document similarity based on sentence structure and content.

3 Implementation

3.1 Syntactic Queries on Medline Abstracts

In an example implementation, a set of 50,000 Medline abstracts is indexed and searched. Admissible queries on the Medline abstracts database are of the same form as sentences in the abstracts. Syntactic queries can target useful subject-verb-object relationships in the database of parsed sentences that results from all indexing steps. Wild-cards are allowed to be substituted for certain parts of speech in the queries. The wild-card in the query must be a valid term in the lexicon preceded by a "#" symbol. Thus the wild-card represents any term in a sentence that shares the same part-of-speech, head-term and dependency relation with the term preceded by a #. Queries are parsed and represented in a similar fashion as sentences, except for the last two keys, namely document # and sentence #, which are dropped in the representation of queries.

Example implementations based on many different embodiments of the technology have been developed:

- Client/server architecture with Java GUI client and CORBA as the communication protocol
- Web server architecture with HTML GUI layout compatible with Netscape and Internet Explorer Web browser
- Dedicate ASP control interface (illustrated in Figure 3)

Other implementations are also contemplated. For example, embodiments of this technology are not restricted to a workstation or desktop implementation, and may be independent of a particular operating system. Also, for example, the interface concept is highly compatible, and ideal for deployment on portable devices, including cellular phones.

An example GUI interface provides five levels of control (Figure 4): two levels for querying and three levels for browsing information returned in response to a query. The levels of control for querying comprise: 1) query type selection; 2) query entry. The levels of control for browsing the results of a query comprise displays of: 1) word dependency maps ranked in decreasing order of statistical relevance; 2) summary list of complete sentences about a target entity, linked to the word dependency maps; 3) full text of the abstract, linked to each sentence in the list above.

The following example *(prepared by a non-biologist)* illustrates the query process:

QUERY

1. Choose from one of the following in a display menu: (a) find functional dependency relationships; (b) find object-subject relationships; (c) search syntactic collocations by example

2. The user chooses (a), and enters the name of an enzyme or gene, whose functions he/she wishes to have summarized. The query could be for instance: "Find all verb dependencies of PLCBeta1"

BROWSING THE RESULTS OF A QUERY

1. The interface presents two statistically ranked lists of actions profiling:

   PLCBeta1 as an object:
   1) activate → PLCBeta1 (157 occurrences)
   2) inhibit → PLCBeta1 (52 occurrences)
   3) block→ PLCBeta1 (7 occurrences)
   ...

   PLCBeta1 as a subject:

   1) PLCBeta1 → hybridize (89 occurrences)
   2) PLCBeta1 → interrupts (12 occurrences)
   3) PLCBeta1 → mediates (11 occurrences)
   4) PLCBeta1 → regulates (10 occurrences)
   ...

2. Each entry in the ranked list above is linked to parent phrases in the corpus of 333,000 Medline abstracts. For instance, when the user selects the keyword "activate", he/she is presented with the list of 157 sentences that summarize what activates PLCBeta1:

   1) "Low concentration of tubulin activated PLCBeta1, whereas higher concentrations inhibited the enzyme."
   2) "Tubulin, Gq and phosphatidylinositol 4,5-bisphosphate interact to activate PLCBeta1"
   3) "A unique ability of tubulin to regulate PLCBeta1 was observed"
   .....

3. Each of the sentences in the list above is linked to the original Medline abstract. The user can select a sentence of particular interest and read the full abstract.

Figures 5 through 7 illustrate an example Java embodiment of the GUI. Figures 8 through 10 illustrate an example HTML/Web browser implementation of the GUI. Finally, Figure 11 illustrates an example sentence similarity operator.

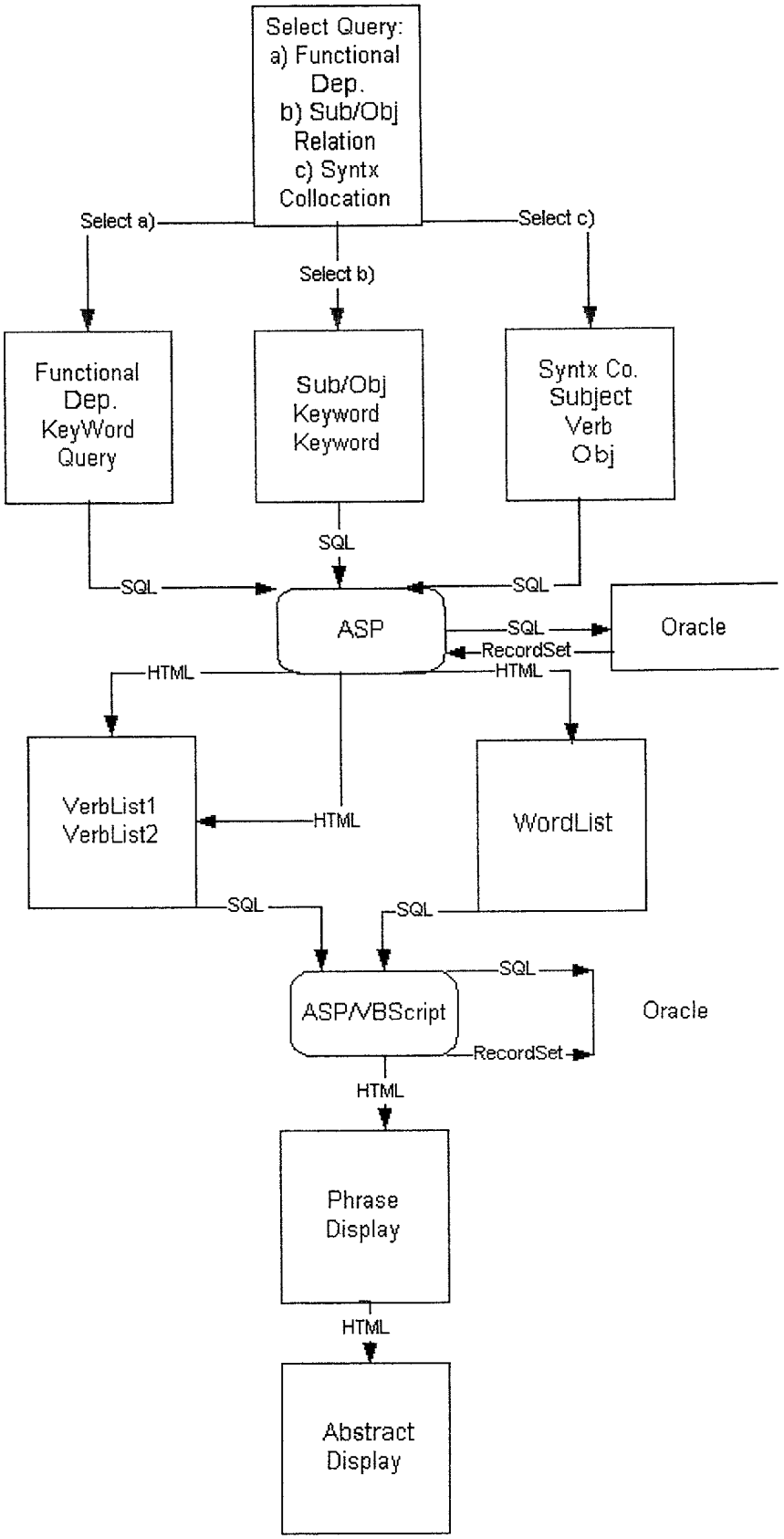
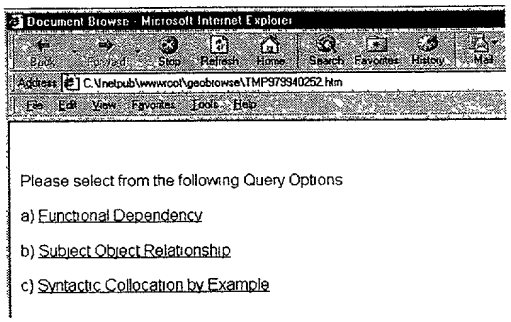
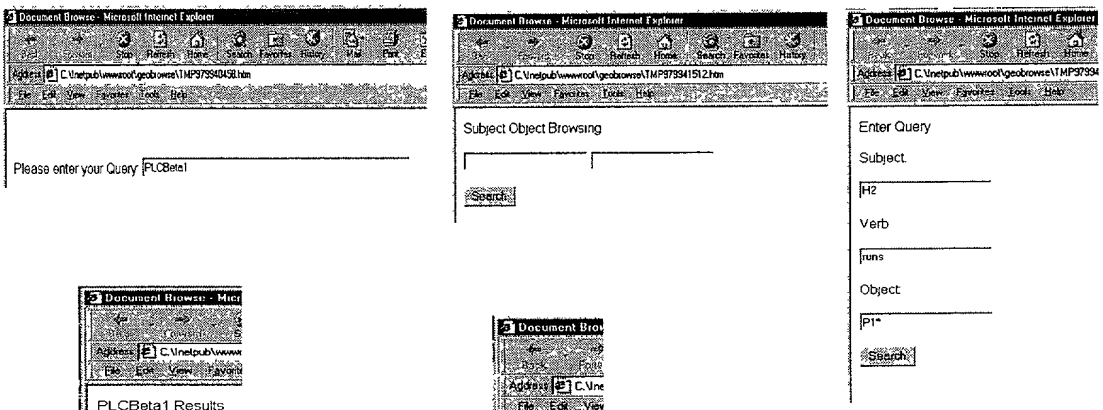


Figure 3: prototype GUI process flowchart

LEVEL 1



LEVEL 2



LEVEL 3

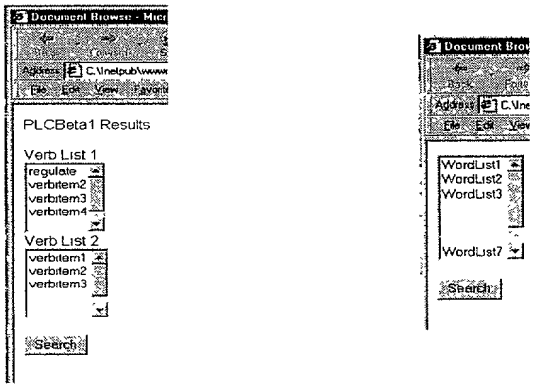
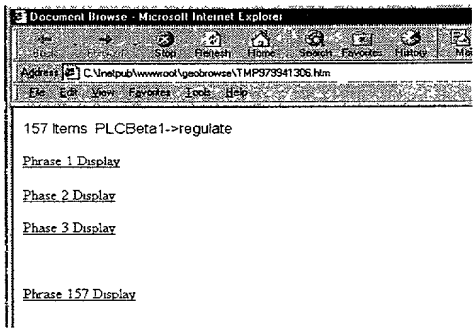
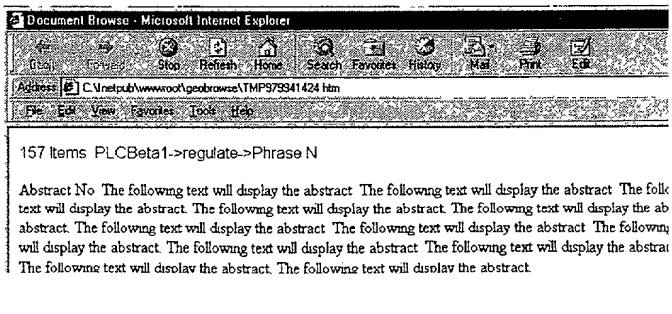


Figure 4: the five levels of GUI control

LEVEL 4



LEVEL 5



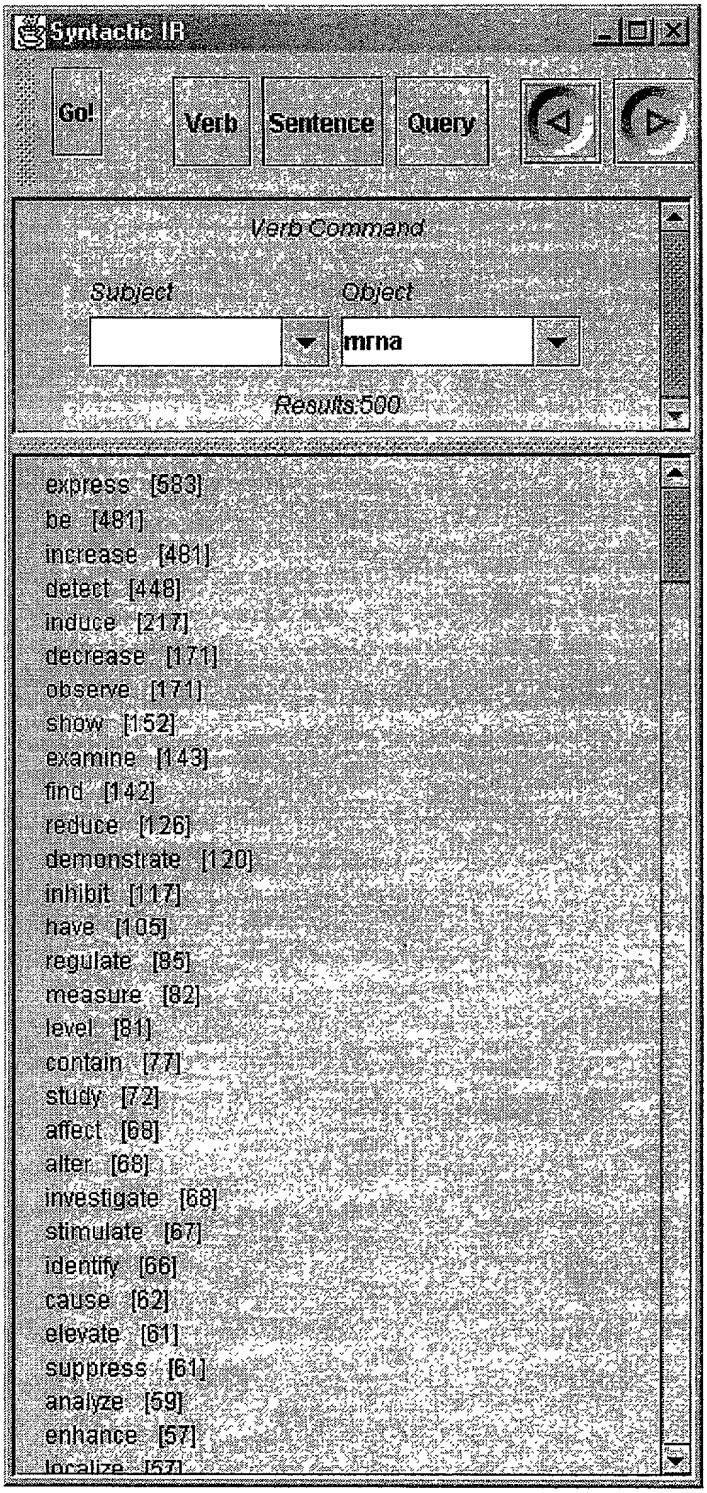


Figure 5

Figure 5 shows an example search tool based on syntactic parser output. A list of verbs or "actions" is shown for which mRNA (messenger RNA) is the object. The verbs are arranged in decreasing order of their statistical significance in a database of 50,000 Medline abstracts.

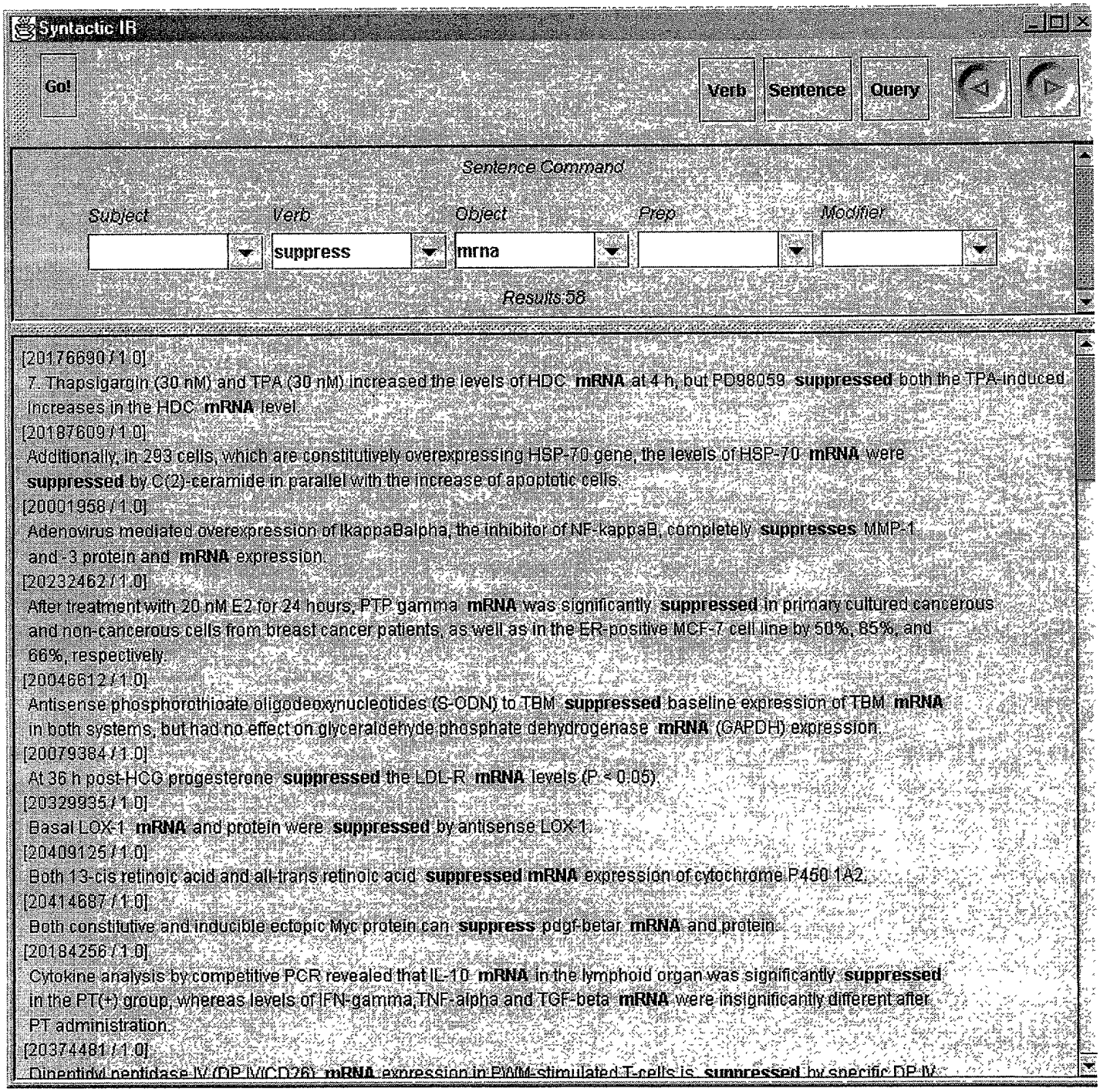


Figure 6

Figure 6 is a continuation of the example of Figure 4. Selecting the verb "suppress" retrieves all sentences that show what suppresses (=verb) mRNA (=object). Note that the search tool can resolve active, as well as passive verb forms.

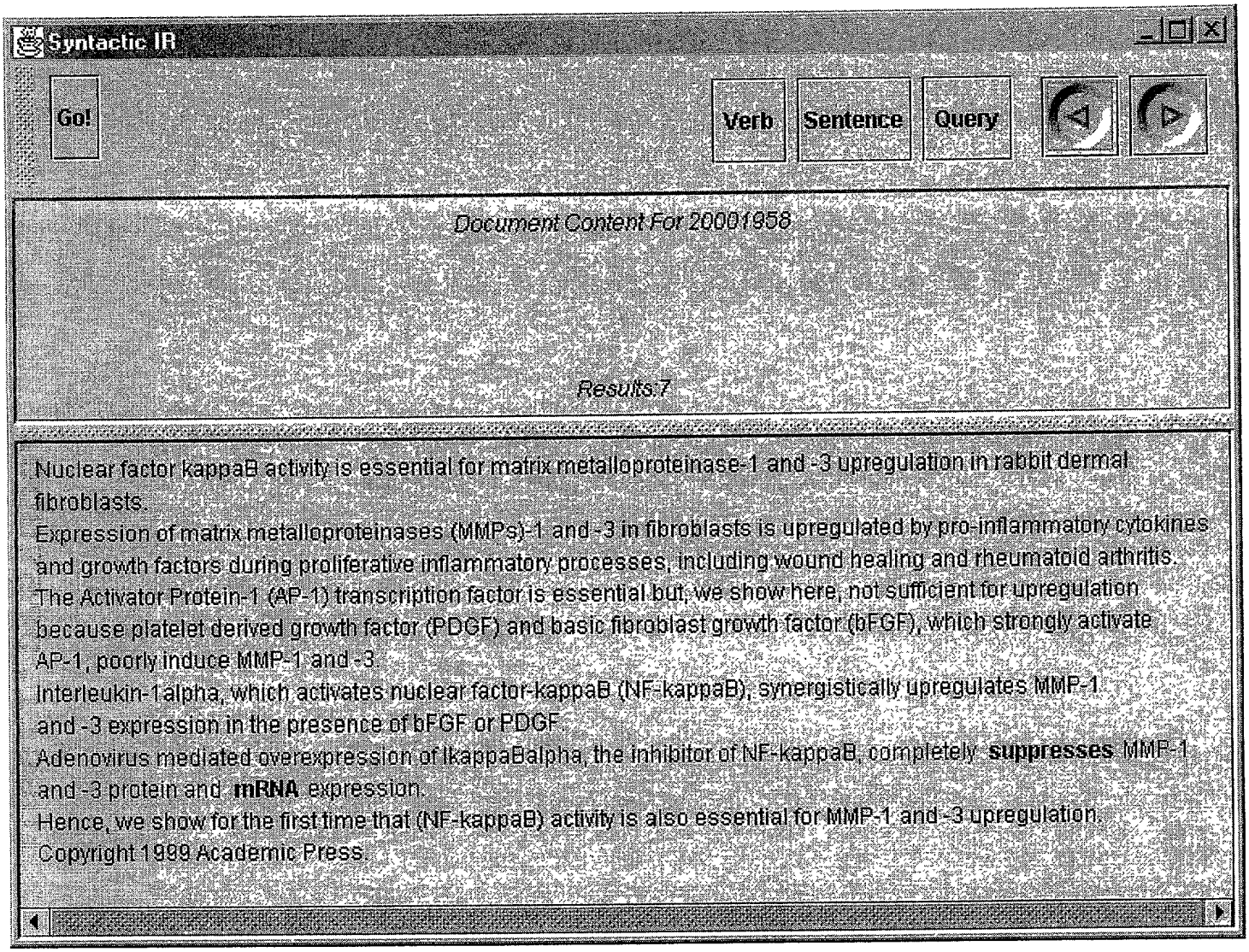


Figure 7

Figure 7 is a continuation of the example of Figure 5. Selecting a sentence returns the full text abstract.

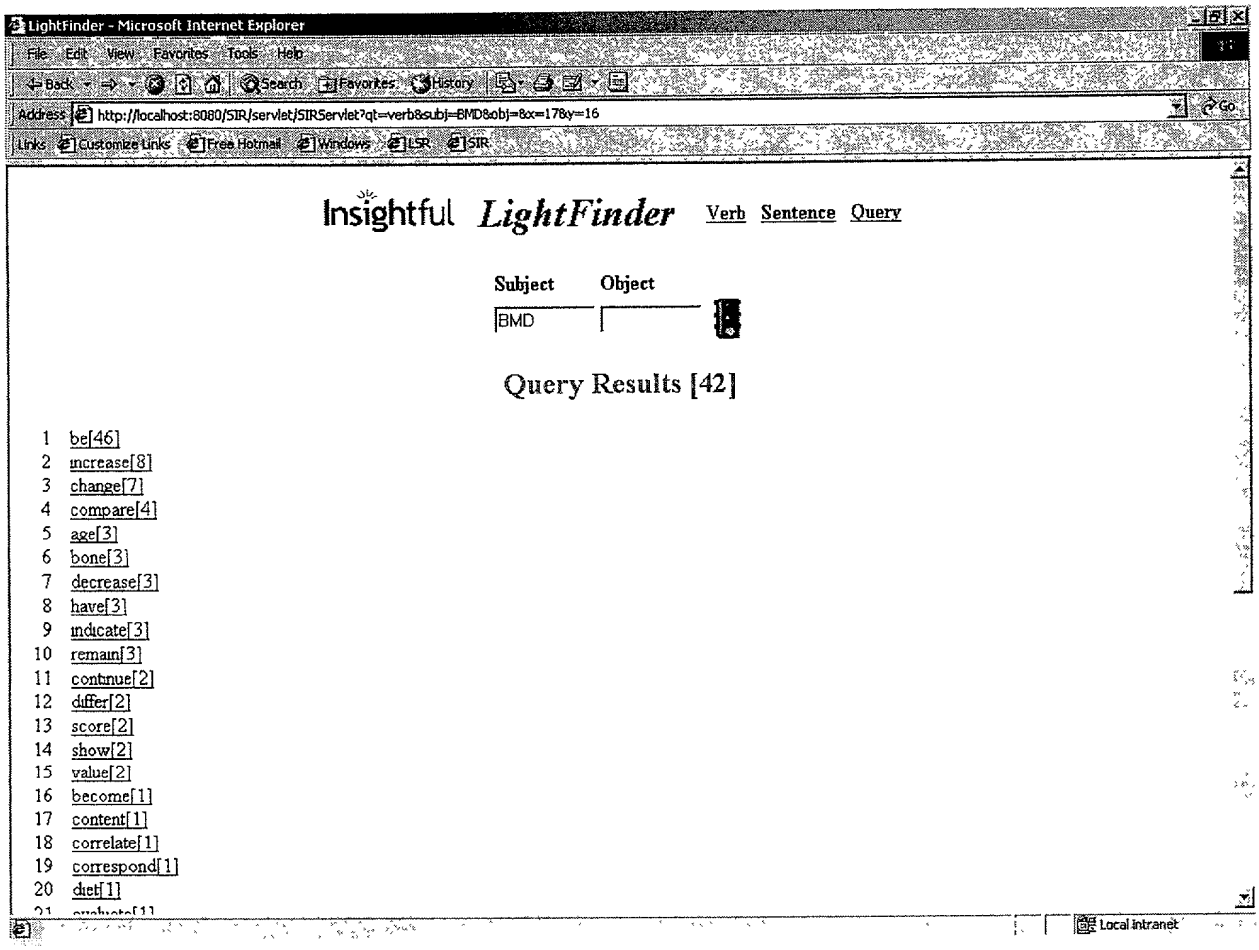


Figure 8

Figure 8 is an example web server embodiment. The web server search tool displays a list of verbs or "actions" for which BMD (Bone Mineral Density) is the subject. The verbs are arranged in decreasing order of their statistical significance in a database of 50,000 Medline abstracts.

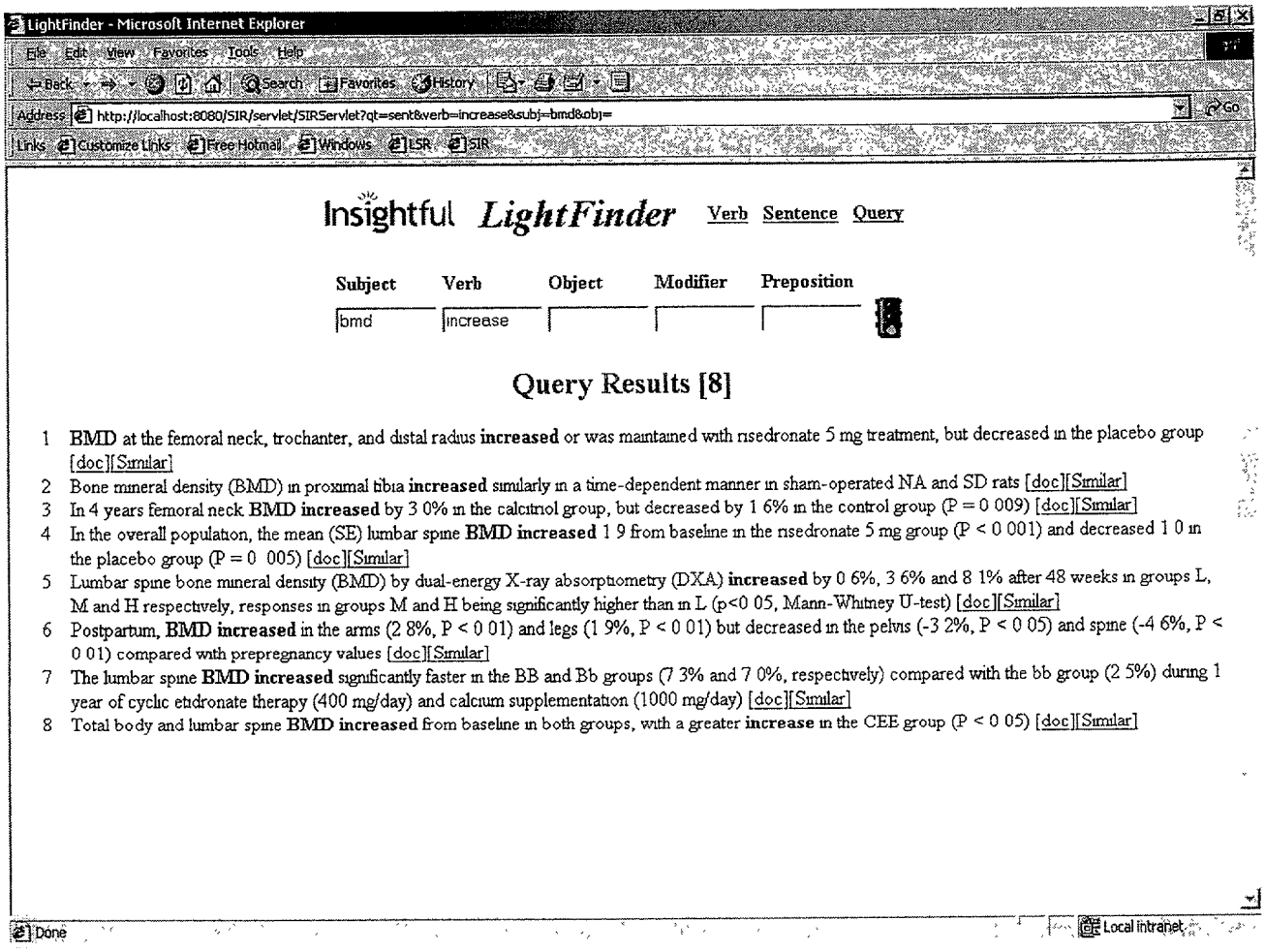


Figure 9

Figure 9 is a continuation of the example of Figure 7. Selecting the verb "increase" retrieves all sentences that show all circumstances where BMD (=subject) increases (=verb) mRNA.

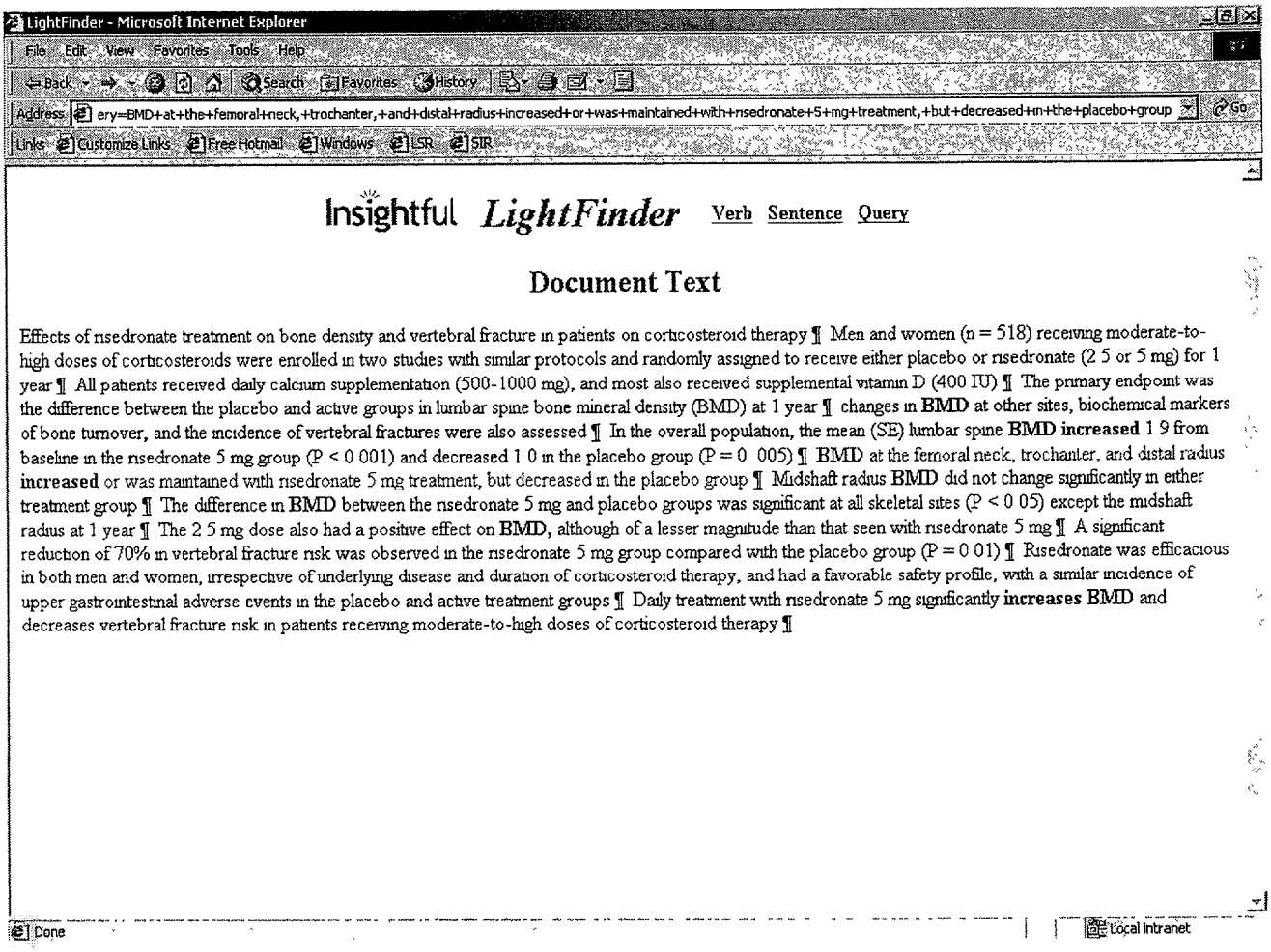


Figure 10

Figure 10 is a continuation of the example of Figure 8. Selecting any sentence returns the full text abstract showing the sentence in context.

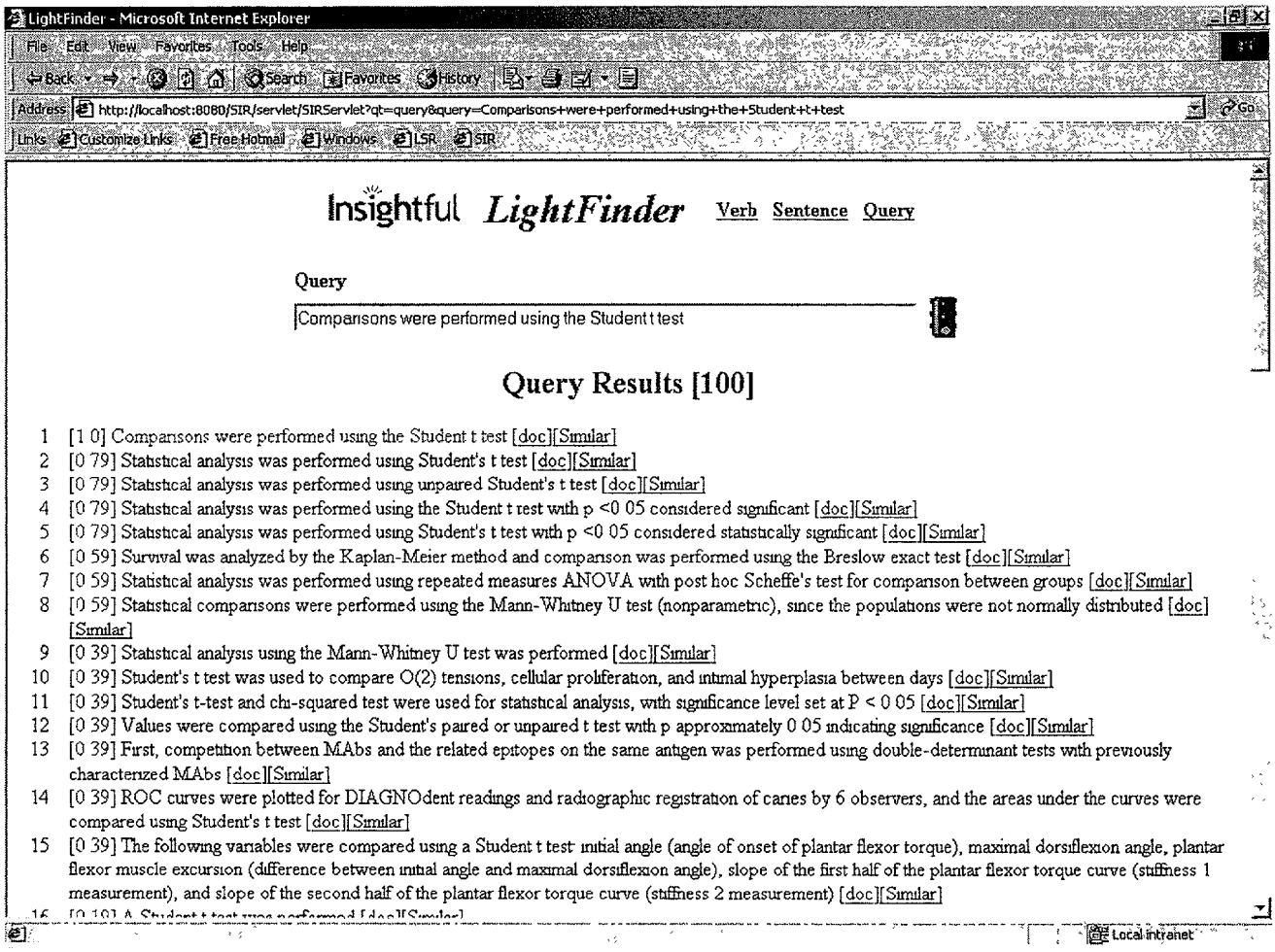


Figure 11

Figure 11 is an example illustration of the sentence similarity operator. The search tool receives the sentence "Comparisons were performed using the Student t test", and determines a list of similar sentences in the corpus.

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APPENDIX B

<DOC>
<DOCNO>
4
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Political background
</HL>
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United Arab Emirates.
Country Profile Uae 1997 / 1998.
Political background.
International relations & defence.
The UAE is a small country surrounded by powerful neighbours in an unstable part of the world
.
Its international relations over the past 20 years have reflected this and it has followed a course of delicate diplomacy.
Although it has been part of the six-member pro-Western Gulf Co- operation Council (GCC) since the latter was founded in 1981, the UAE has tended to take a more accommodating stance than its co-members, especially Saudi Arabia and Kuwait, towards perceived external threats such as Iran.
This reflects the fact that both Dubai and Sharjah have substantial Iranian populations, and that Iran is an important economic partner for the UAE.
Relations with Iran.
With the outbreak of the Iran-Iraq war in 1980, the UAE found itself walking a diplomatic tightrope.
It was one of the first Arab countries to receive Iranian officials after the 1979 Islamic revolution and continued to welcome them even after the war with Iraq had started.
However, it also contributed to Iraq's war effort when it became clear that Iraq might lose the struggle if it did not receive backing.
After the Gulf war of 1991 the UAE made great efforts to forge closer ties with Iran but in 1992 Iran took control of the whole of the Gulf island of Abu Musa which it had shared with Sharjah since 1971.
The action made the UAE nervous and since then this unease has translated into overt opposition to perceived Iranian expansionism.
Since 1995 alarm has grown as Iran has strengthened its grip on the islands of Abu Musa, Greater Tunb and Lesser Tunb.
The UAE has frequently called for the dispute to be resolved either through bilateral negotiations or by the International Court of Justice in The Hague.
Its position has been supported by the GCC and the Arab League, both of which have argued that a normalisation in ties with Iran is dependent on the affair being resolved.
Relations with Iran have caused internal friction within the federation.
Given its strong trade links and large indigenous Iranian population, Dubai has maintained a conciliatory stance towards Tehran, arguing that close contacts will ultimately lead to a solution of the dispute.
In contrast, Sharjah and Ras al-Khaimah, whose territorial waters adjoin the three islands, have called for greater steps to be taken in forcing the Iranian regime either to hand back the islands or, at the very least, to allow a joint administration to be set up.
Relations with Iraq.
Despite supporting Iraq in the Iran-Iraq war, the UAE has also had much to fear from the ambitions of the Iraqi leader, Saddam Hussein.
In 1988 Baghdad accused the UAE, along with Kuwait, of breaking OPEC oil quotas, driving prices down and depriving Iraq of revenue to rebuild its economy after the war with Iran.
The fact that this was one reason given by Iraq for its invasion of Kuwait in 1990 was not lost on the UAE.
Nevertheless, Sheikh Zayed has taken a lead in calling on the UN to relax sanctions against Iraq in order to ease the suffering of its people.
More important to Sheikh Zayed, however, is the desire to build up Iraq to balance Iranian power.
Dubai, too, is interested in having sanctions on Iraq lifted to take advantage of the trade that would then ensue.
Oil wealth.
Over the past few years the country's oil wealth has been a mixed blessing.
The UAE was criticised for allegedly not bearing enough of the burden in the Gulf war effort against Iraq, particularly as economically, it emerged as one of the few regional beneficiaries.
Although it mobilised its troops and paid around $10bn towards the cost of the war, it gained more from the crisis than it lost.
It benefited, for instance, from higher oil revenue as prices rose and it increased production to make up for lost Iraqi and Kuwaiti output.
Dubai gained from the relocation of business from Kuwait.
During the 1990s the UAE has taken a back seat in OPEC, generally supporting the line adopted by Saudi Arabia.
Dubai's refusal to make pro- rata cuts in line with the federation's oil production quota has placed the burden of compliance solely on Abu Dhabi.
This has caused some difficulties for Abu Dhabi, given that its foreign oil partners have ploughed significant sums into raising the emirate's sustainable oil capacity, much of which has remained idle.
Indeed, Abu Dhabi is reckoned to have over 500,000 barrels/day (b/d) of spare capacity in place.
However, a 25% drop in Dubai's oil production over the period 1993-97 has provided some relief for Abu Dhabi allowing it to raise output over the period by about 150,000 b/d to an estimated 1.9m b/d.
New OPEC quotas, which came into force on January 1st 1998, have also proved a blessing for the oil-rich emirate, as the 205,000 b/d increase in the UAE quota (taking it to 2.366m b/d) has been covered solely by Abu Dhabi.
Total Abu Dhabi production now stands at over 2.1m b/d.
Defence pacts.
Since the end of the Gulf war, the UAE and the rest of the GCC have been reluctant to rely for their security on the so-called Damascus Declaration group of countries: the GCC, Egypt and Syria.
The latter two sent troops to the Gulf to help to oust Iraq from Kuwait, after which they agreed to station troops permanently in the region.
However, GCC states, even though they suffer from a lack of manpower, have been reluctant to put the arrangement into practice.
Even internally, the GCC has been unable to agree on a joint force.
Oman, for instance, has persistently advocated the expansion of the current joint force from a few thousand to 100,000 troops, but the UAE has opposed this because it fears domination by Saudi Arabia.
Instead, the UAE has looked to the West, in particular to the US, to guarantee its defence.
In 1991 a loose defence pact was signed, giving the US rights to base troops and equipment in the UAE.
Since then the UAE (in fact mainly Abu Dhabi) has spent billions of dollars on buying sophisticated military equipment, but it lacks the personnel and skills to make full use of them.
The purchases were essentially designed to draw the US and other Western powers such as France into close arrangements with the UAE.
This table shows the Defence forces, 1996.
Armed forces is _NUM.
Army is _NUM.
Navy is _NUM.
Air Force is _NUM.
Source: International Institute for Strategic Studies, The Military.
Compared with other Arab countries, the UAE's armed forces as a percentage of the national population are large.
This is because federal arrangements coexist with individual emirate defence provisions.
Although the different emirates nominally unified their forces in 1976, there is still little federal identity.
Since the end of the Gulf war, the number of foreign nationals in the military has fallen to around 30% of the total.
Defence is a major item of government expenditure.
In 1996 the federal ministries of defence, justice and the interior together spent just over 40% of the total budget.
Abu Dhabi and, to a lesser extent, Dubai make separate defence purchases, with the costs considered a contribution to the federal budget (see Reference table 1).
A significant increase in UAE defence spending has been expected since 1995, when the UAE announced its intention to spend $10bn-12bn on new weaponry.
The procurement programme was held up as a sign of the federation's desire to bolster its defensive capabilities in the face of the perceived Iranian threat and to play a more active role in safeguarding shipping through the strategic straits of Hormuz.
This table shows the Military indicators.
(1996 unless otherwise indicated).
Total active armed forces is _NUM.
Military expenditure ($ m) is _NUM.
Military expenditure (% of GDP) is _NUM.
Military expenditure per head ($) is _NUM.
Arms imports ($ m; 1994) is _NUM.
Arms imports (% total imports; 1994) is _NUM.
Cumulative arms transfers deliveries ($ m; 1992-94) is _NUM.
Armed forces per '000 people (soldiers) is _NUM.
Sources: International Institute for Strategic Studies, The Military.
Balance 1996/97; US Arms Control and Disarmament Agency, World Military.
Despite years of discussions with prospective suppliers, only one major deal has been signed, a $3.4bn contract with the French fighter aircraft firm, Dassault, for 30 new Mirage 2000-09 generation fighters, some in replacement of 22 existing Mirages.
This should leave UAE officials more time to evaluate offers for a further order for 50 aircraft worth some $4.6bn.
Lockheed Martin, a US manufacturer of F-16 aircraft, is the likeliest winner, with the UK's British Aerospace (BAe) and the Eurofighter 2000 next in line.
No award has yet been made for a $1bn order to supply the navy with up to eight ocean-capable patrol boats (OCPBs) and a $1bn-2bn order for six small frigates.
Pressure to award the second contract has eased after the purchase in 1996 of two second-hand frigates from the Netherlands.
These are due to be delivered in the first half of 1998.
The delays in awarding the contracts have been attributed to Abu Dhabi re-evaluating the
</TEXT>
</DOC>

programme and assessing means of alternative financing, including the possibility of payment in oil.
</TEXT>
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<DOC>
<DOCNO>
5
</DOCNO>
<HL>
Economy
</HL>
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United Arab Emirates.
Country Profile Uae 1997 / 1998.
Economy.
Economic structure.
This table shows the Main economic indicators, 1996.
Real GDP growth(a) (%) is _NUM.
Consumer price inflation (%) is _NUM.
Current account ($ m) is _NUM.
External debt(a) ($ bn) is _NUM.
Exchange rate (Dh:$) is _NUM.
Population(b) (m) is _NUM.
(a) EIU estimate.
(b) Official preliminary estimate.
The mainstay of the UAE economy is oil and gas (see Reference tables 10 and 11).
By far the largest oil producer is Abu Dhabi, but some contribution comes from Dubai and, to a much lesser extent, Sharjah and Ras al-Khaimah (see Reference table 13).
Despite oil's importance, its contribution to GDP has been declining in recent years from about 60% in 1980 to just 35% in 1996.
Nevertheless, the significance of this decline should not be overstated.
Much of the non-oil economy depends on the public sector and public-sector contracts, and the amount of public spending is directly related to oil revenue.
Government consumption is a major element in demand in the economy, equivalent to over 16 % of GDP (see Reference tables 8 and 9).
Weak oil prices during the period 1993-95 were reflected in a low average level of GDP growth (see Reference table 7).
This table shows the Gross domestic product by emirate.
(current prices).
1995 is _NUM.
Dh m is _TABLE % share Dh m % share.
Abu Dhabi is _NUM.
Dubai is _NUM.
Sharjah is _NUM.
Ras al-Khaimah is _NUM.
Ajman is _NUM.
Fujairah is _NUM.
Umm al-Qaiwain is _NUM.
Total is _NUM.
Sources: Federal Ministry of Planning, Annual Economic Report 1996; UAE.
Dubai is the centre for regional trade.
Its importance to the region in this respect has been growing, especially since the Gulf war, and now extends as far as the southern republics of the former Soviet Union.
Re- exports are the mainstay of the trading system, with Dubai's foreign trade more than twice the value of its own national GDP.
This table shows the Re-exports by emirate.
($ m).
1995 is _NUM.
Dubai is _NUM.
Sharjah is _NUM.
Abu Dhabi is _NUM.
Other (mainly non-recorded) is _NUM.
Total is _NUM.
The value of UAE re-exports in 1996 was around $10.1bn (30% of total exports).
A significant proportion-about 40%-is unrecorded.
This comprises goods leaving Dubai by dhow (a vessel characteristic of the Gulf) and merchandise passing through the Jebel Ali Free Zone, also in Dubai.
In total, Dubai accounts for around 85% of re-exports.
This table shows the UAE merchandise exports.
($ m).
1995 is _NUM.
Total is _NUM.
Crude oil is _NUM.
Gas is _NUM.
Total oil & gas is _NUM.
Re-exports is _NUM.
Other non-oil exports is _NUM.
Total non-oil exports is _NUM.
The UAE economy is rather larger than Kuwait's, but less than one-third the size of Saudi Arabia's.
Its GDP per head is broadly similar to Kuwait's, but it is well behind that of leading industrial countries.
This table shows the Comparative economic indicators, 1996.
UAE is _TABLE Saudi Arabia Kuwait Japan.
GDP ($ bn) is _NUM.
GDP per head ($) is _NUM.
Oil production ('000 b/d) is _NUM.
Exports of goods ($ bn) is _NUM.
Imports of goods ($ bn) is _NUM.
</TEXT>
</DOC>

APPENDIX C

Governing-term-1

752
Afghan Afghanistan
Afghani Afghanistan
Albanian Albania
Algerian Algeria
American US
Andorran Andorra
Angolan Angola
Anguillan Anguille
Antiguan Antigua
Antilles Netherland-Antilles
Argentine Argentina
Argentinian Argentina
Aruban Aruba
Australian Australia
Austrian Austria
Azerbaijani Azerbaijan
Bahamian Bahamas
Bahraini Bahrain
Bangladeshi Bangladesh
Barbadian Barbados
Basothian Basotho
Batswanian Batswana
Belarusian Belarus
Belgian Belgium
Belizean Belize
Beninese Benin
Bermudan Bermuda
Bhutanese Bhutan
Bolivian Bolivia
Bosnia Bosnia-and-Hercegovina
Bosnian Bosnia-and-Hercegovina
Botswanian Botswana
Brazilian Brazil
Brazzaville-Congolese Congo-(Brazzaville)
British United-Kingdom
Bruneian Brunei
Bulgarian Bulgaria
Burkina Burkina-Faso
Burkinabe Burkina-Faso
Burma Myanmar-(Burma)
Burmese Myanmar-(Burma)
Burundian Burundi
Cambodian Cambodia
Cameroonian Cameroon
Canadian Canada
Cape-Verdian Cape-Verde
Cayman Cayman-Islands
Central-African Central-African-Republic
Chadian Chad
Chilean Chile
Chinese China
Colombian Colombia
Comoran Comoros
Congo Congo-(Democratic-Republic)
Congolese Congo-(Democratic-Republic)
Costa-Rican Costa-Rica
Cote-D'Ivoire Cote-d`Ivoire
Croatian Croatia
Cuban Cuba

Country-term-2

Cypriot Cyprus
Czech Czech-Republic
Czechoslovak Czech-Republic
Czechoslovakian Czech-Republic
Dane Denmark
Danish Denmark
Democratic-Republic-of-the-Congo Congo-(Democratic-Republic)
Djiboutian Djibouti
Dominican Dominican-Republic
Dutch Netherlands
Ecuadorian Ecuador
Egyptian Egypt
English United-Kingdom
Englishman United-Kingdom
Englishmen United-Kingdom
Englishwoman United-Kingdom
Englishwomen United-Kingdom
Equatoguinean Equatorial-Guinea
Eritrean Eritrea
Estonian Estonia
Ethiopian Ethiopia
Fijian Fiji
Finnish Finland
French France
Gabonese Gabon
Gambian The-Gambia
German Germany
Ghanaian Ghana
Greek Greece
Greenlandic Greenland
Grenadian Grenada
Guaman Guam
Guatemalan Guatemala
Guianese Guiana
Guinea-Bissauan Guinea-Bissau
Guinean Guinea
Guyanese Guyana
Haitian Haiti
Helenian Greece
Hercegovina Bosnia-and-Hercegovina
Honduran Honduras
Hong-Kongnese Hong-Kong
Hungarian Hungary
Icelander Iceland
Icelandic Iceland
Indian India
Indonesian Indonesia
Iranian Iran
Iraqi Iraq
Irish Ireland
Irishman Ireland
Irishwoman Ireland
Israeli Israel
Italian Italy
Ivorian Ivory-Coast
Jamaican Jamaica
Japanese Japan
Jordanian Jordan
Kazak Kazakhstan
Kazakh Kazakhstan

Gaverny-term -3

Kazakstan	Kazakhstan
Kenyan	Kenya
Korean	South-Korea
Kosovo	Bosnia-and-Hercegovina
Kuwaiti	Kuwait
Kyrgyz	Kyrgyzstan
Laotian	Laos
Latvian	Latvia
Lebanese	Lebanon
Lesothian	Lesotho
Liberian	Liberia
Libyan	Libya
Liechtensteiner	Liechtenstein
Lithuanian	Lithuania
Luxembourger	Luxembourg
Lybia	Libya
Lybian	Libya
Macauan	Macau
Macedonian	Macedonia
Madagascan	Madagascar
Mahoran	Mahora
Malawian	Malawi
Malaysian	Malaysia
Maldivian	Maldives
Malian	Mali
Maltese	Malta
Marshallese	Marshall-Islands
Martiniquais	Martinique
Mauritanian	Mauritania
Mauritian	Mauritius
Mexican	Mexico
Moldavia	Moldova
Moldavian	Moldova
Moldovan	Moldova
Monacan	Monaco
Mongolian	Mongolia
Montenegro	Yugoslavia
Montserratian	Montserrat
Moroccan	Morocco
Motswanian	Motswana
Mozambican	Mozambique
Namibian	Namibia
Nepalese	Nepal
New-Caledonian	New-Caledonia
New-Zealander	New-Zealand
Nicaraguan	Nicaragua
Nigerian	Nigeria
Nigerien	Niger
North-Korean	North-Korea
Norwegian	Norway
Omani	Oman
Pacific-Islander	Pacific-Islands
Pakistani	Pakistan
Palestine	The-Occupied-Territories
Palestinian	The-Occupied-Territories
Panamanian	Panama
Papua-New-Guinean	Papua-New-Guinea
Papuan	Papua-New-Guinea
Paraguayan	Paraguay
Peruvian	Peru

Philippine Philippines
Philippino Philippines
Polish Poland
Portuguese Portugal
Puerto-Rican Puerto-Rico
Qatari Qatar
Romanian Romania
Russian Russia
Russian-Federation Russia
Rwandan Rwanda
Saint-Lucian Saint-Lucia
Salvadoran El-Salvador
Samoan Samoa
Sanmarinese San-Marino
Sao-Tomean Sao-Tome-and-Principe
Saudi Saudi-Arabia
Saudi-Arabian Saudi-Arabia
Scotland United-Kingdom
Scottish United-Kingdom
Senegalese Senegal
Serbia Yugoslavia
Serbia-Montenegro Yugoslavia
Serbian Yugoslavia
Seychellois Seychelles
Sierra-Leonean Sierra-Leone
Singaporean Singapore
Slovak Slovakia
Slovakian Slovakia
Slovenian Slovenia
Solomon-Islander Solomon-Islands
Somali Somalia
South-African South-Africa
South-Korean South-Korea
Soviet Russia
Soviet-Union Russia
Spaniard Spain
Spanish Spain
Sri-Lankan Sri-Lanka
Sudanese Sudan
Surinam Suriname
Surinamese Suriname
Swazi Swaziland
Swede Sweden
Swedish Sweden
Swiss Switzerland
Syrian Syria
Taiwanese Taiwan
Tajik Tajikistan
Tajiki Tajikistan
Tanzanian Tanzania
Thai Thailand
Timorese East-Timor
Togolese Togo
Tongan Tonga
Trinidad Trinidad-and-Tobago
Trinidadian Trinidad-and-Tobago
Tunisian Tunisia
Turk Turkey
Turk-Islander Turks-and-Caicos-Islands
Turkish Turkey

Govern_stem-5

Turkmen	Turkmenistan
U.K.	United-Kingdom
U.S.	US
U.S.A.	US
U.S.S.R.	Russia
UK	United-Kingdom
US	US
USA	US
USSR	Russia
USSR	Russia
Ugandan	Uganda
Ukrainian	Ukraine
Ukranian	Ukraine
United-States	US
United-States-of-America	US
Uruguayan	Uruguay
Uzbek	Uzbekistan
Vanuatuan	Vanuatu
Venezuelan	Venezuela
Vietnamese	Vietnam
Virgin-Islander	British-Virgin-Islands
West-Samoan	Western-Samoa
Yemeni	Yemen
Yugoslav	Yugoslavia
Yugoslavian	Yugoslavia
Zairean	Zaire
Zambian	Zambia
Zimbabwean	Zimbabwe
afghan	Afghanistan
afghani	Afghanistan
afghanistan	Afghanistan
albania	Albania
albanian	Albania
algeria	Algeria
algerian	Algeria
american	US
andorra	Andorra
andorran	Andorra
angola	Angola
angolan	Angola
anguillan	Anguille
anguille	Anguille
antigua	Antigua
antiguan	Antigua
antilles	Netherland-Antilles
argentina	Argentina
argentine	Argentina
argentinian	Argentina
aruba	Aruba
aruban	Aruba
australia	Australia
australian	Australia
austria	Austria
austrian	Austria
azerbaijan	Azerbaijan
azerbaijani	Azerbaijan
bahamas	Bahamas
bahamian	Bahamas
bahrain	Bahrain
bahraini	Bahrain

bangladesh Bangladesh
bangladeshi Bangladesh
barbadian Barbados
barbados Barbados
basothian Basotho
basotho Basotho
batswana Batswana
batswanian Batswana
belarus Belarus
belarusian Belarus
belgian Belgium
belgium Belgium
belize Belize
belizean Belize
benin Benin
beninese Benin
bermuda Bermuda
bermudan Bermuda
bhutan Bhutan
bhutanese Bhutan
bolivia Bolivia
bolivian Bolivia
bosnia Bosnia-and-Hercegovina
bosnia-and-hercegovina Bosnia-and-Hercegovina
bosnia-and-hercegovina Bosnia-and-Hercegovina
bosnia-and-hercegovina Bosnia-and-Hercegovina
bosnian Bosnia-and-Hercegovina
botswana Botswana
botswanian Botswana
brazil Brazil
brazilian Brazil
brazzaville-congolese Congo-(Brazzaville)
british United-Kingdom
british-virgin-islands British-Virgin-Islands
brunei Brunei
bruneian Brunei
bulgaria Bulgaria
bulgarian Bulgaria
burkina Burkina-Faso
burkina-faso Burkina-Faso
burkinabe Burkina-Faso
burma Myanmar-(Burma)
burmese Myanmar-(Burma)
burundi Burundi
burundian Burundi
cambodia Cambodia
cambodian Cambodia
cameroon Cameroon
cameroonian Cameroon
canada Canada
canadian Canada
cape-verde Cape-Verde
cape-verdian Cape-Verde
cayman Cayman-Islands
cayman-islands Cayman-Islands
central-african Central-African-Republic
central-african-republic Central-African-Republic
chad Chad
chadian Chad
chile Chile

Covery-term-7

chilean Chile
china China
chinese China
colombia Colombia
colombian Colombia
comoran Comoros
comoros Comoros
congo Congo-(Democratic-Republic)
congo-(brazzaville) Congo-(Brazzaville)
congo-(democratic-republic) Congo-(Democratic-Republic)
congo-(democratic-republic) Congo-(Democratic-Republic)
congolese Congo-(Democratic-Republic)
costa-rica Costa-Rica
costa-rican Costa-Rica
cote-d'ivoire Cote-d`Ivoire
cote-d'ivoire Cote-d`Ivoire
croatia Croatia
croatian Croatia
cuba Cuba
cuban Cuba
cypriot Cyprus
cyprus Cyprus
czech Czech-Republic
czech-republic Czech-Republic
czechoslovak Czech-Republic
czechoslovakian Czech-Republic
dane Denmark
danish Denmark
democratic-republic-of-the-congo Congo-(Democratic-Republic)
denmark Denmark
djibouti Djibouti
djiboutian Djibouti
dominican Dominican-Republic
dominican-republic Dominican-Republic
dutch Netherlands
east-timor East-Timor
ecuador Ecuador
ecuadorian Ecuador
egypt Egypt
egyptian Egypt
el-salvador El-Salvador
english United-Kingdom
englishman United-Kingdom
englishmen United-Kingdom
englishwoman United-Kingdom
englishwomen United-Kingdom
equatoguinean Equatorial-Guinea
equatorial-guinea Equatorial-Guinea
eritrea Eritrea
eritrean Eritrea
estonia Estonia
estonian Estonia
ethiopia Ethiopia
ethiopian Ethiopia
fiji Fiji
fijian Fiji
finland Finland
finnish Finland
france France
french France

Gaverg-term-B

gabon Gabon
gabonese Gabon
gambian The-Gambia
german Germany
germany Germany
ghana Ghana
ghanaian Ghana
greece Greece
greece Greece
greek Greece
greenland Greenland
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grenada Grenada
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guaman Guam
guatemala Guatemala
guatemalan Guatemala
guiana Guiana
guianese Guiana
guinea Guinea
guinea-bissau Guinea-Bissau
guinea-bissauan Guinea-Bissau
guinean Guinea
guyana Guyana
guyanese Guyana
haiti Haiti
haitian Haiti
helenian Greece
hercegovina Bosnia-and-Hercegovina
honduran Honduras
honduras Honduras
hong-kong Hong-Kong
hong-kongnese Hong-Kong
hungarian Hungary
hungary Hungary
iceland Iceland
icelander Iceland
icelandic Iceland
india India
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indonesia Indonesia
indonesian Indonesia
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iranian Iran
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iraqi Iraq
ireland Ireland
irish Ireland
irishman Ireland
irishwoman Ireland
israel Israel
israeli Israel
italian Italy
italy Italy
ivorian Ivory-Coast
ivory-coast Ivory-Coast
jamaica Jamaica
jamaican Jamaica
japan Japan

Gavery-term-9

japanese Japan
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kazakh Kazakhstan
kazakhstan Kazakhstan
kazakstan Kazakhstan
kenya Kenya
kenyan Kenya
korean South-Korea
kosovo Bosnia-and-Hercegovina
kuwait Kuwait
kuwaiti Kuwait
kyrgyz Kyrgyzstan
kyrgyzstan Kyrgyzstan
laos Laos
laotian Laos
latvia Latvia
latvian Latvia
lebanese Lebanon
lebanon Lebanon
lesothian Lesotho
lesotho Lesotho
liberia Liberia
liberian Liberia
libya Libya
libyan Libya
liechtenstein Liechtenstein
liechtensteiner Liechtenstein
lithuania Lithuania
lithuanian Lithuania
luxembourg Luxembourg
luxembourger Luxembourg
lybia Libya
lybian Libya
macau Macau
macauan Macau
macedonia Macedonia
macedonian Macedonia
madagascan Madagascar
madagascar Madagascar
mahora Mahora
mahoran Mahora
malawi Malawi
malawian Malawi
malaysia Malaysia
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mali Mali
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malta Malta
maltese Malta
marshall-islands Marshall-Islands
marshallese Marshall-Islands
martiniquais Martinique
martinique Martinique
mauritania Mauritania
mauritanian Mauritania
mauritian Mauritius

mauritius	Mauritius
mexican	Mexico
mexico	Mexico
moldavia	Moldova
moldavian	Moldova
moldova	Moldova
moldovan	Moldova
monacan	Monaco
monaco	Monaco
mongolia	Mongolia
mongolian	Mongolia
montenegro	Yugoslavia
montserrat	Montserrat
montserratian	Montserrat
moroccan	Morocco
morocco	Morocco
motswana	Motswana
motswanian	Motswana
mozambican	Mozambique
mozambique	Mozambique
myanmar-(burma)	Myanmar-(Burma)
namibia	Namibia
namibian	Namibia
nepal	Nepal
nepalese	Nepal
netherland-antilles	Netherland-Antilles
netherlands	Netherlands
new-caledonia	New-Caledonia
new-caledonian	New-Caledonia
new-zealand	New-Zealand
new-zealander	New-Zealand
nicaragua	Nicaragua
nicaraguan	Nicaragua
niger	Niger
nigeria	Nigeria
nigerian	Nigeria
nigerien	Niger
north-korea	North-Korea
north-korean	North-Korea
norway	Norway
norwegian	Norway
oman	Oman
omani	Oman
pacific-islander	Pacific-Islands
pacific-islands	Pacific-Islands
pakistan	Pakistan
pakistani	Pakistan
palestine	The-Occupied-Territories
palestinian	The-Occupied-Territories
panama	Panama
panamanian	Panama
papua-new-guinea	Papua-New-Guinea
papua-new-guinean	Papua-New-Guinea
papuan	Papua-New-Guinea
paraguay	Paraguay
paraguayan	Paraguay
peru	Peru
peruvian	Peru
philippine	Philippines
philippines	Philippines

philippino Philippines
poland Poland
polish Poland
portugal Portugal
portuguese Portugal
puerto-rican Puerto-Rico
puerto-rico Puerto-Rico
qatar Qatar
qatari Qatar
romania Romania
romanian Romania
russia Russia
russia Russia
russian Russia
russian-federation Russia
rwanda Rwanda
rwandan Rwanda
saint-lucia Saint-Lucia
saint-lucian Saint-Lucia
salvadoran El-Salvador
samoa Samoa
samoan Samoa
san-marino San-Marino
sanmarinese San-Marino
sao-tome-and-principe Sao-Tome-and-Principe
sao-tomean Sao-Tome-and-Principe
saudi Saudi-Arabia
saudi-arabia Saudi-Arabia
saudi-arabian Saudi-Arabia
scotland United-Kingdom
scottish United-Kingdom
senegal Senegal
senegalese Senegal
serbia Yugoslavia
serbia-montenegro Yugoslavia
serbian Yugoslavia
seychelles Seychelles
seychellois Seychelles
sierra-leone Sierra-Leone
sierra-leonean Sierra-Leone
singapore Singapore
singaporean Singapore
slovak Slovakia
slovakia Slovakia
slovakian Slovakia
slovenia Slovenia
slovenian Slovenia
solomon-islander Solomon-Islands
solomon-islands Solomon-Islands
somali Somalia
somalia Somalia
south-africa South-Africa
south-african South-Africa
south-korea South-Korea
south-korea South-Korea
south-korean South-Korea
soviet Russia
soviet-union Russia
spain Spain
spaniard Spain

govern-term-12

spanish Spain
sri-lanka Sri-Lanka
sri-lankan Sri-Lanka
sudan Sudan
sudanese Sudan
surinam Suriname
suriname Suriname
surinamese Suriname
swazi Swaziland
swaziland Swaziland
swede Sweden
sweden Sweden
swedish Sweden
swiss Switzerland
switzerland Switzerland
syria Syria
syrian Syria
taiwan Taiwan
taiwanese Taiwan
tajik Tajikistan
tajiki Tajikistan
tajikistan Tajikistan
tanzania Tanzania
tanzanian Tanzania
thai Thailand
thailand Thailand
the-US US
the-USA US
the-gambia The-Gambia
the-occupied-territories The-Occupied-Territories
the-us the-US
the-usa the-US
timorese East-Timor
togo Togo
togolese Togo
tonga Tonga
tongan Tonga
trinidad Trinidad-and-Tobago
trinidad-and-tobago Trinidad-and-Tobago
trinidadian Trinidad-and-Tobago
tunisia Tunisia
tunisian Tunisia
turk Turkey
turk-islander Turks-and-Caicos-Islands
turkey Turkey
turkish Turkey
turkmen Turkmenistan
turkmenistan Turkmenistan
turks-and-caicos-islands Turks-and-Caicos-Islands
u.k. U.K.
u.s. US
u.s.a. US
u.s.s.r. U.S.S.R.
uganda Uganda
ugandan Uganda
uk UK
ukraine Ukraine
ukrainian Ukraine
ukranian Ukraine
united-kingdom United-Kingdom

Govern tem-13

united-kingdom	United-Kingdom
united-kingdom	United-Kingdom
united-states	US
united-states-of-america	US
united-states-of-america	US
uruguay	Uruguay
uruguayan	Uruguay
usa	US
ussr	USSR
uzbek	Uzbekistan
uzbekistan	Uzbekistan
vanuatu	Vanuatu
vanuatuan	Vanuatu
venezuela	Venezuela
venezuelan	Venezuela
vietnam	Vietnam
vietnamese	Vietnam
virgin-islander	British-Virgin-Islands
west-samoan	Western-Samoa
western-samoa	Western-Samoa
yemen	Yemen
yemeni	Yemen
yugoslav	Yugoslavia
yugoslavia	Yugoslavia
yugoslavia	Yugoslavia
yugoslavia	Yugoslavia
yugoslavian	Yugoslavia
zaire	Zaire
zairean	Zaire
zambia	Zambia
zambian	Zambia
zimbabwe	Zimbabwe
zimbabwean	Zimbabwe

* [illegible]

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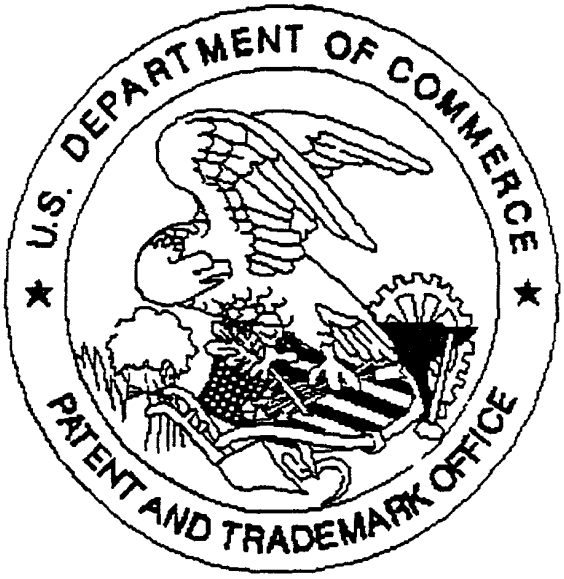

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■ ***Scanned copy is best available.*** APPENDIX. pages 11, 17, 18, pages 19, 20, 21, 22, 23, 24, 26, 27, are very Dark